

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE  
REQUEST FOR FILING NATIONAL PHASE OF  
PCT APPLICATION UNDER 35 U.S.C. 371 AND 37 CFR 1.494 OR 1.495

To: Hon. Commissioner of Patents  
Washington, D.C. 20231



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TRANSMITTAL LETTER TO THE UNITED STATES  
DESIGNATED/ELECTED OFFICE (DO/EO/US)

Atty Dkt: PM 276618 /T299013US/KIN  
M# /Client Ref.

From: Pillsbury Winthrop LLP, IP Group:

Date: February 1, 2001

This is a **REQUEST** for **FILING** a PCT/USA National Phase Application based on:

- |                              |                                  |                                   |
|------------------------------|----------------------------------|-----------------------------------|
| 1. International Application | 2. International Filing Date     | 3. Earliest Priority Date Claimed |
| <u>PCT/FI/00/0494</u>        | <u>2</u> <u>June</u> <u>2000</u> | <u>4</u> <u>June</u> <u>1999</u>  |
| <u>FI</u> country code       | Day MONTH Year                   | Day MONTH Year                    |
4. Measured from the earliest priority date in item 3, this PCT/USA National Phase Application Request is being filed within:
- (a) ☒ 20 months from above item 3 date (b) ☐ 30 months from above item 3 date,
- (c) Therefore, the due date (unextendable) is February 4, 2001
5. Title of Invention METHOD FOR CHANNEL CONFIGURATION OF CELLULAR RADIO NETWORK, AND CELLULAR RADIO NETWORK
6. Inventor(s) VAISANEN, Vello

Applicant herewith submits the following under 35 U.S.C. 371 to effect filing:

7. ☒ Please immediately start national examination procedures (35 U.S.C. 371 (f)).
8. ☐ A copy of the International Application as filed (35 U.S.C. 371(c)(2)) is transmitted herewith (file if in English but, if in foreign language, file only if not transmitted to PTO by the International Bureau) including:
- a. ☐ Request;  
b. ☐ Abstract;  
c.        pgs. Spec. and Claims;  
d.        sheet(s) Drawing which are ☐ informal ☐ formal of size ☐ A4 ☐ 11"
9. ☒ A copy of the International Application has been transmitted by the International Bureau.
10. A translation of the International Application into English (35 U.S.C. 371(c)(2))
- a. ☒ is transmitted herewith including: (1) ☒ Request; (2) ☒ Abstract;  
(3) 15 pgs. Spec. and Claims;  
(4) 4 sheet(s) Drawing which are:  
☐ informal ☒ formal of size ☒ A4 ☐ 11"
- b. ☐ is not required, as the application was filed in English.
- c. ☐ is not herewith, but will be filed when required by the forthcoming PTO Missing Requirements Notice per Rule 494(c) if box 4(a) is X'd or Rule 495(c) if box 4(b) is X'd.
- d. ☐ Translation verification attached (not required now).

526 Rec'd PCT/PTO

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11. ☒ **PLEASE AMEND** the specification before its first line by inserting as a separate paragraph:  
 a. ☒ --This application is the national phase of international application PCT/FI00/00494 filed June 2, 2000 which designated the U.S.--  
 b. ☐ --This application also claims the benefit of U.S. Provisional Application No. 60/ filed ---
12. ☐ Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371(c)(3)), i.e., **before 18th month from first priority date above in item 3, are transmitted herewith (file only if in English) including:**
13. ☒ PCT Article 19 claim amendments (if any) have been transmitted by the International Bureau
14. ☐ Translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)), i.e., **of claim amendments made before 18th month, is attached (required by 20th month from the date in item 3 if box 4(a) above is X'd, or 30th month if box 4(b) is X'd, or else amendments will be considered canceled).**
15. **A declaration of the inventor** (35 U.S.C. 371(c)(4))  
 a. ☒ is submitted herewith ☒ Original ☐ Facsimile/Copy  
 b. ☐ is not herewith, but will be filed when required by the forthcoming PTO Missing Requirements Notice per Rule 494(c) if box 4(a) is X'd or Rule 495(c) if box 4(b) is X'd.
16. **An International Search Report (ISR):**  
 a. Was prepared by ☐ European Patent Office ☐ Japanese Patent Office ☒ Other  
 b. ☒ has been transmitted by the international Bureau to PTO.  
 c. ☒ copy herewith (1 pg(s)) ☒ plus Annex of family members (1 pg(s)).
17. **International Preliminary Examination Report (IPER):**  
 a. ☒ has been transmitted (if this letter is filed after 28 months from date in item 3) in English by the International Bureau with Annexes (if any) in original language.  
 b. ☐ copy herewith in English.  
 c.1 ☐ IPER Annex(es) in original language ("Annexes" are amendments made to claims/spec/drawings during Examination) including attached amended:  
 c.2 ☐ Specification/claim pages # --- claims # ---  
 Dwg Sheets # ---  
 d. ☐ Translation of Annex(es) to IPER **(required by 30<sup>th</sup> month due date, or else annexed amendments will be considered canceled).**
18. **Information Disclosure Statement** including:  
 a. ☒ Attached Form PTO-1449 listing documents  
 b. ☐ Attached copies of documents listed on Form PTO-1449  
 c. ☒ A concise explanation of relevance of ISR references is given in the ISR.
19. ☒ **Assignment** document and Cover Sheet for recording are attached. Please mail the recorded assignment document back to the person whose signature, name and address appear at the end of this letter.
20. ☐ Copy of Power to IA agent.
21. ☐ **Drawings** (complete only if 8d or 10a(4) not completed): --- sheet(s) per set: ☐ 1 set informal;  
☐ Formal of size ☐ A4 ☐ 11"
22. Small Entity Status ☐ is **Not** claimed ☐ is claimed **(pre-filing confirmation required)**  
 22(a) --- (No.) Small Entity Statement(s) enclosed (since 9/8/00 Small Entity Statements(s) not essential to make claim)
23. **Priority** is hereby claimed under 35 U.S.C. 119/365 based on the priority claim and the certified copy, both filed in the International Application during the international stage based on the filing in (country) **FINLAND** of:  
Application No. Filing Date Application No. Filing Date  
 (1) 991285 June 4, 1999 (2) --- ---  
 (3) --- (4) ---  
 (5) --- (6) ---
- a. ☒ See Form PCT/IB/304 sent to US/DO with copy of priority documents. If copy has not been received, **please proceed promptly to obtain same from the IB.**  
 b. ☐ Copy of Form PCT/IB/304 attached.

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RE: USA National Filing of PCT/FI00/00494

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24. Attached:

25. Preliminary Amendment:

25.5 Per Item 17.c2, cancel original pages #\_\_\_\_\_, claims #\_\_\_\_\_, Drawing Sheets #

26. Calculation of the U.S. National Fee (35 U.S.C. 371 (c)(1)) and other fees is as follows:

Based on amended claim(s) per above item(s) ☐ 12, ☐ 14, ☐ 17, ☐ 25, ☐ 25.5 (hilitte)

Total Effective Claims	24	minus 20 =	4	x \$18/\$9	=	\$72	966/967
Independent Claims	2	minus 3 =	0	x \$80/\$40	=	\$0	964/965
If any proper (ignore improper) Multiple Dependent claim is present,				add \$270/\$135	=	+0	968/969

BASIC NATIONAL FEE (37 CFR 1.492(a)(1)-(4)): →→ BASIC FEE REQUIRED, NOW →→→→

A. If country code letters in item 1 are not "US", "BR", "BB", "TT", "MX", "IL", "NZ", "IN" or "ZA"

See item 16 re:

1. Search Report was <u>not</u> prepared by EPO or JPO -----	add \$1000/\$500	960/961
2. Search Report was prepared by EPO or JPO -----	add \$860/\$430 +1000	970/971

SKIP B, C, D AND E UNLESS country code letters in item 1 are "US", "BR", "BB", "TT", "MX", "IL", "NZ", "IN" or "ZA"

→ <input type="checkbox"/> B.	If USPTO did not issue <u>both</u> International Search Report (ISR) <u>and</u> (if box 4(b) above is X'd) the International Examination Report (IPER), -----	add \$970/\$485	+0	960/961
→ <input type="checkbox"/> C.	If USPTO issued ISR but not IPER (or box 4(a) above is X'd), -----	add \$710/\$355	+0	958/959
→ <input type="checkbox"/> D.	If USPTO issued IPER but IPER Sec. V boxes <u>not all</u> 3 YES, -----	add \$690/\$345	+0	956/957
→ <input type="checkbox"/> E.	If international preliminary examination fee was paid to USPTO <u>and</u> Rules 492(a)(4) and 496(b) <u>satisfied</u> (IPER Sec. V <u>all</u> 3 boxes YES for <u>all</u> claims), -----	add \$100/\$50	+0	962/963

27.	<b>SUBTOTAL =</b>	<u>\$1072</u>	
28.	If Assignment box 19 above is X'd, add Assignment Recording fee of ---\$40	+40	(581)
29.	Attached is a check to cover the -----	<b>TOTAL FEES</b>	<u>\$1112</u>

Our Deposit Account No. 03-3975

Our Order No. 60258 276618

C#

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**CHARGE STATEMENT:** The Commissioner is hereby authorized to charge any fee specifically authorized hereafter, or any missing or insufficient fee(s) filed, or asserted to be filed, or which should have been filed herewith or concerning any paper filed hereafter, and which may be required under Rules 16-18 and 492 (missing or insufficient fee only) now or hereafter relative to this application and the resulting Official document under Rule 20, or credit any overpayment, to our Account/Order Nos. shown above for which purpose a duplicate copy of this sheet is attached.

This CHARGE STATEMENT does not authorize charge of the issue fee until/unless an issue fee transmittal form is filed

Pillsbury Winthrop LLP  
Intellectual Property Group

By Atty: Richard C. Irving

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NOTE: File in duplicate with 2 postcard receipts (PAT-103) & attachments.

# APPLICATION UNDER UNITED STATES PATENT LAWS

Atty. Dkt. No. PM 276618/T299013US/KIN/her  
(M#)

Invention: METHOD FOR CHANNEL CONFIGURATION OF CELLULAR RADIO NETWORK, AND  
CELLULAR RADIO NETWORK

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## This is a:

- ☐ Provisional Application
- ☐ Regular Utility Application
- ☐ Continuing Application  
☒ The contents of the parent are incorporated  
by reference
- ☒ PCT National Phase Application
- ☐ Design Application
- ☐ Reissue Application
- ☐ Plant Application
- ☐ Substitute Specification  
Sub. Spec. Filed \_\_\_\_\_  
in App. No. \_\_\_\_\_ / \_\_\_\_\_
- ☐ Marked up Specification re  
Sub. Spec. filed \_\_\_\_\_  
In App. No. \_\_\_\_\_ / \_\_\_\_\_

## SPECIFICATION

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WO 00/76242

PCT/FI00/00494

METHOD FOR CHANNEL CONFIGURATION OF CELLULAR RADIO NETWORK,  
AND CELLULAR RADIO NETWORK

FIELD OF THE INVENTION

- The invention relates to a method for performing channel
- 5 configuration of base stations in a cellular radio network intended for office environments, and an apparatus implementing the method.

BACKGROUND OF THE INVENTION

- In a cellular radio network system, the size of cells may vary according to the predicted traffic amount of an area, for instance. In a sparsely
- 10 populated area, the cells often are large macro cells, whereas in population centres, the reuse of frequencies must be more efficient, which aim is reached by reducing the size of cells, i.e. by using micro or pico cells. A micro cell covers a multi-storey office building, for instance, or a section of a street, whereas a pico cell covers an area of a few offices inside a building, for
- 15 instance. The diameter of a pico cell is typically from a few metres to a few dozen metres, while the transmission power level of the base station is a few dozen or hundred milliwatts, the size of a micro cell is in the range of 10 to 400 metres, and macro cells may be several kilometres in size, while the transmission power level is dozens of watts.

- 20 In practise, the structure of cellular radio networks in population centres are often such that a network formed by macro cells, such as a GSM network (890 to 915 MHz in uplink direction and 935 to 960 MHz in downlink direction), uses a different frequency band than a micro cell network, such as a DCS network (1710 to 1785 MHz in uplink direction and 1805 to 1880 MHz
- 25 in downlink direction), whereby the traffic of one network does not cause interference to that of the other.

- Frequency planning becomes, however, more complicated if networks using the same frequency range have overlapping coverage areas having different cell sizes. Such a situation arises, for instance, when office
- 30 base station networks comprising micro or pico cells and operating on GSM frequencies operate on the coverage area of a GSM network comprising macro cells and operating in a densely populated area. One solution to using frequencies in such a situation is to allocate a certain frequency range to the macro cell network and another to the micro cell network from the frequency
- 35 band allocated to the GSM network. Alternatively, the micro cell network can

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be implemented in such a manner that the channels it requires are dynamically borrowed from temporarily unused channels of the macro cell network. With respect to the capacity of the macro cell network, neither solution leads to a satisfactory result.

- 5 The frequency planning of a micro cell network can also be implemented using fixed channel allocation (FCA) and the same frequency space with the macro cell network, whereby the operation of the micro cell network must be ensured by careful frequency planning so as to prevent the macro cell network which has a higher transmission power level from causing
- 10 interference to the traffic of the micro cell network. Especially in situations where changes are made to the frequency usage of the macro cell network, the operation of the micro cell network must be ensured by a fast re-planning and re-selection of frequencies and a network operation testing combined to them. Today, the testing of the frequency set to be used is, in practice, done
- 15 manually by measurement personnel. The drawback is that the testing is slow and laborious, for instance in measurements done at night or repeated regularly.

#### BRIEF DESCRIPTION OF THE INVENTION

- 20 It is thus the object of the invention to implement a method and an apparatus implementing the method so as to solve the above problems. This is achieved by the method disclosed in the following. The method in question is a method for performing channel configuration in a cellular radio network for office use located in the operating area of a macro cell network. In the method: a logical control channel to be transmitted on a physical channel of a macro
- 25 cell in the macro cell network is selected as the channel to be tested; the base station of the cellular radio network for office use and the terminals in the coverage area of the base stations in the cellular radio network for office use are directed to use the channel to be tested; a connection is established by remote control between two or more terminals through the serving base
- 30 stations on the tested channel and a measurement report is made concerning the quality of the connection; the next control channel of a macro cell in the macro cell network is selected for testing until all control channels of the desired macro cells have been tested; the channels whose use guarantees the best range in the cellular radio network for office use are decided on based on

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the measurement reports; the base stations of the cellular radio network for office use are directed to use the channels guaranteeing the best range.

The invention also relates to a cellular radio network comprising one or more macro cell base stations, each coverage area being a macro cell and the macro cells forming a macro cell network; a cellular radio network for office use operating in the operating area of the macro cell network, which cellular radio network for office use comprises at least one base station and at least one terminal in radio connection with the base station. The cellular radio network also comprises a controller co-ordinating channel configuration, which controller comprises means for selecting as the channel to be tested a logical control channel to be transmitted on a physical channel of a macro cell, means for directing a base station of the cellular radio network for office use to use the channel to be tested, means for establishing by remote control a connection between two or more terminals through base stations serving the terminals on the channel to be tested, means for making a measurement report concerning the quality of the connection, means for selecting the next macro cell control channel for testing until all control channels of the desired macro cells have been tested, means for deciding on the basis of the measurement reports the channels whose use guarantees the best range in the cellular radio network for office use, and means for directing the base stations to use the channels guaranteeing the best range.

Preferred embodiments of the invention are set forth in the dependent claims.

The invention is based on the idea that the channels used in a cellular radio network for office use using the same channel space and operating in the operating area of a macro cell network are found by utilizing the continuous transmission on the control channels of the macro cell network. The method of the invention and the apparatus employing the invention makes it possible to automate the channel configuration of a cellular radio network for office use.

The method and system of the invention provide several advantages. Since in the method of the invention channel configuration is performed automatically by means of a separate application, the configuration can be performed during the night, for instance, before any changes made to the macro cell or weekly to ensure the operation of the network. Automatic selection of optimal channels by means of computers is quite fast and less

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susceptible to errors than a manual configuration. The method and apparatus of the invention thus ensure the operation of a cellular radio network for office use in a situation where macro and micro cell networks use the same channel space.

## 5 BRIEF DESCRIPTION OF THE FIGURES

In the following, the invention will be described by means of preferred embodiments with reference to the attached drawings in which

Figure 1 shows a cellular radio network having both macro and micro cells,

10 Figure 2 is a flow chart illustrating a solution of the invention for finding frequencies in a cellular radio network for office use,

Figure 3 shows a preferred embodiment of a solution of the invention for finding channels for a cellular radio network for office use in the operating area of a macro cell network,

15 Figure 4 shows a cellular radio network for office use of the invention.

## DETAILED DESCRIPTION OF THE INVENTION

In the following, the invention will be described in a GSM cellular radio network employing TDMA (time division multiple access) without, however, being limited to such a network. Thus in the described example, a physical channel refers to a frequency/time-slot combination, but in other types of systems, a physical channel can be implemented in another manner, for instance in a CDMA (code division multiple access) system as a frequency/spreading code combination. The solution of the invention can also be implemented in a hybrid system employing several multiple access methods simultaneously. The described cellular radio network for office use can be a normal cellular radio network in structure as shown in Figure 4, or it can be implemented so that the base stations are connected to each other through a local area network of the office. In such a case, the base station controller resides in the same local area network and is connected through an interface to a data network, such as an IP network. Even though the following describes the invention with reference to a cellular radio network operating in an office environment, it is clear that the solution of the invention for performing channel configuration can also be implemented in factories, temporary camping environments or corresponding cellular radio networks

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made up of pico or micro cells operating in the operating area of a macro cell network.

Figure 1 shows a cellular radio network comprising macro cells 102, each transmitting to three sectors 104 and divided from each other by dashed lines in the cells 102. Cell groups 106 comprising seven cells have been formed of the macro cells 102, the cell groups being outlined by a thicker line in Figure 1. Figure 1 also shows a group of micro cells 110 in the cellular radio network, the micro cells being numbered from 10 to 14.

The macro cell network shown in Figure 1 comprises cells 102 having three sectors, and frequencies a, b and c, on which the transmission to the various sectors 104 takes place, are marked in each cell. The cells 102 are shown as hexagons, which illustrates the theoretical coverage area of the base station of the cell. In practice, the coverage area of the cells is not necessarily a hexagon, but the size of the cell depends decidedly on the contour of the terrain and the existence of buildings, for instance. In practice, cells overlap and are partly on top of each other to achieve as good as possible a range. Depending on the required capacity, the letters a, b and c of the cell sectors can also be thought to describe frequency groups comprising several frequencies instead of individual frequencies. Cell groups 106 to 108 comprising seven cells 102 have been formed of the macro cells 102, the cell groups being outlined by a thicker line in Figure 1. The cells of the cell group 106 up on the left transmit above and to the right on frequency range 4a, to the right and below on frequency 4b, and to the left frequency range 4c. In the adjacent cell groups 107 to 108, the transmission directions have been turned 120 degrees so that the cell group 107 transmits to the left on frequency/frequency range 6a and the cell group 108 transmits below to the right on frequency/frequency range 3a.

By way of example, a group of micro cells 110, numbered 10 to 14 and whose frequency ranges are shown in table 1, are depicted in Figure 1 hierarchically with the macro cells described above. The table shows that the use of frequencies of the micro cells is implemented so that the interference caused by the macro cell network below to the micro cell network remains at minimum. Figure 1 and table 1 show that if changes are made to the use of frequencies in the macro cell network, the micro or pico cell network must adapt to these changes in such a manner that new frequencies that do not suffer from interference from the macro cells are found for the micro cells.

Micro cell	Frequency group
10	3A, 3C
11	2B, 2C
12	6A, 6B
13	6B, 6C
14	7A, 7B

Table 1. Frequency ranges used by micro cells

- 5 Figure 2 shows a method of the invention for finding and testing pico/micro cell network channels. Even though in Figure 2, channels are referred to on a general level, the following illustrates the invention in a GSM cellular radio network employing TDMA, and a channel refers to a frequency/time-slot combination. In the start step 200 of the method, the
- 10 frequencies in the macro cell network have been changed or a periodic, for instance weekly, search for best frequencies is being made. A threshold value, such as a bit error rate (BER), is set in method block 205 for calls to be made in later method blocks, and the quality of calls undershooting the threshold and consequently, the used channel can be accepted. In addition to the bit error,
- 15 the call quality can also be evaluated on the basis of a signal interference rate (SIR), carrier interference rate (CIR), reception power or any other known quality measurement method. If the threshold for the call quality is exceeded, the interference caused by the macro cell network is considered to be too high for the used channel, and it as well as the used frequency are rejected.
- 20 The frequency to be tested is selected in method block 210, which frequency belongs to a predefined frequency group, for instance, from which the micro cell network base stations can take frequencies for their use. In a preferred embodiment of the invention, the frequency to be tested is a BCCH (broadcast control channel) frequency of a GSM cellular radio network
- 25 comprising macro cells, i.e. a physical frequency on which the cellular radio network transmits information on a logical BCCH channel to terminals. It is advantageous to use a BCCH in measurements of the invention, because said control channel has continuous traffic in the macro cell network, as the base station transmits information on the cell to the terminals in a point-to-multipoint
- 30 manner. Because transmission on the BCCH channel is continuous, it is

possible to perform measurements at night. On traffic channels, the measurements would not give realistic results since the amount of traffic is minimal. Network management of the micro cell network being measured and the surrounding macro cell network is preferably performed from one and the same location and with the same network management system, whereby the network management system knows the BCCH frequencies of all macro cells surrounding the micro cell network, and of the frequencies, at least the one that is the best and has the least interference is according to the invention selected for the micro cell network. Managing both networks with the same network management system also provides the advantage that the network management system knows the macro cell control channels in which the traffic volume varies strongly and which thus are possibly disturbed, and consequently, it knows not to test or select them for use in the office base station network.

The method steps from step 210 to 240 are repeated in order to go through all frequencies in the frequency group and to select the best of them for the use of the base stations or alternatively in order to end the search for frequencies when a sufficient number of good frequencies that exceed the threshold values are found. In a preferred embodiment, the best BCCH frequency is found for the office network from those of the surrounding macro cells. In method step 215, the base stations of the micro cell network and the terminals in radio connection with the base stations are set to use the frequency to be tested. Next in step 220, a call connection is set up between the terminals, whereby a radio connection is established from the terminals to the base stations serving them, or to one base station if both terminals are in the same cell. The terminal transmits a measurement report on the quality of the connection between the terminal and the base station to the base station which forwards it to the network management system. In a preferred embodiment, the micro and macro cells are managed by the same network management system and the BCCH channels of the networks are synchronised with each other. When calls are then made in the micro cell network on a BCCH frequency, it is known where in the frequency the BCCH channel is used and the call can be set up synchronised with said channel, thus making interference measurement relevant. In an alternative embodiment, if the macro and micro cell networks are not synchronised with each other, in a TDMA network a call is set up between the terminals in all

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time-slots of the BCCH frequency being tested, because it is not certain that the macro and micro cell networks are synchronised with each other. In the situation described above, it is possible to either first make the call in all time-slots of the frequency being tested and then compare the quality information of all connections with the threshold value, or make the calls in such a manner that after each call made in a time-slot, the quality information is compared with the threshold value. Because all time-slots are tested, the macro cell BCCH channel and the channel being tested overlap at least partly and relevant information is obtained on how much interference the macro cell network causes to the micro cell network.

In method step 225, the collected quality information of connections is compared with the threshold values set in step 210, and on the basis of this comparison, a decision is made in method step 230 on whether the used frequency is sufficiently good to be used in a micro cell network in the vicinity of a macro cell network. If the frequency does not meet the requirements set by the threshold values, the routine returns through method step 232 to step 210 where a new frequency is selected for testing; in one embodiment, this is the BCCH frequency of another cell. If the frequency, especially if it is a BCCH channel used in establishing a connection, exceeds the pre-set threshold value, it is accepted in step 235, after which the routine moves to method step 240 in which a check is made to see if the required frequencies have been found for the base stations. In practice, one frequency is usually enough for an office network due to the low transmission power levels of the base stations and, therefore, the short ranges. If there is a need to have more frequencies, the routine returns to step 210 to select a new frequency for testing. Otherwise, the search for frequencies can be stopped in step 240, and the routine can move to method step 245 in which the office base stations are directed to use the best channels found by the method. It is obvious to a person skilled in the art that in the process described above, the threshold value used as a quality indicator can be suitably altered so that a required number of frequencies are found. If during the first round of going through the pre-set frequency group, for instance, not enough frequencies are found, the threshold value, such as the bit error ratio, can be lowered and a new round of steps can be performed, in which case more frequencies meet the set threshold value.

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In the following, the invention will be described by means of Figure 3 which shows a macro cell network comprising base stations 302A to 302G. To illustrate the invention, a channel group has been allocated for each macro cell base station 302A to 302G in the figure, and the base station has a radio connection with the terminals in the coverage area of the base station on these channels. In the figure, each macro cell base station 302A to 302G has a marked control channel CH1 to CH7 on which the macro cell base station signals information on the cell to the terminals within the area of the cell. An office network 300 comprising office base stations 304A to 304D is located in the operating area of the macro cell network. According to the method shown in Figure 2, the best channels are searched for the office network 300 from the control channels of the surrounding macro cell network. The search for a good channel can, for instance, be started by selecting as the first channel the control channel CH1 of the base station 302A. If the connection established on the control channel exceeds the quality criteria set for it, it is selected for use in the office network. If a TDMA network were used, all time-slots of the frequency comprising the control channel (e.g. a BCCH channel) would then be selected for use in the office network. With reference to Figure 3, when the control channel CH1 has been tested, the base stations of the office network are set on the control channel CH2 of the next macro cell base station 302B, and the next connection is established on it between the terminals within the coverage area of the office network. All or a part of the control channels in the surrounding macro cell network are gone through in this manner. In the example in Figure 3, the macro cell network uses 7 control channels which would then all be tested in this manner. In the example in the figure, the base stations 302B and 302D are located furthest away from the office network and would most likely produce the best measurement results with minimum interference on calls made on the control channels, and the channels CH2 and CH4 would then be selected for use in the office network.

Figure 4 shows the essential parts of the infrastructure of a cellular radio network for office use of the invention comprising a network management system 414, a data network 402, control means 404, a terminal 406, a base station 304, a base station controller 410 and a channel search application 412. It is obvious to a person skilled in the art that a cellular radio network also comprises other components and that the figure only shows the elements essential for the invention. The network management system 414

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builds, manages and maintains the cellular radio network. Building the network refers here to defining the base stations 304 as parts of the cellular radio network and configuring them so as to enable communication between the terminals 406 through them. The network management system 414 initiates the quality measurements on connections between the terminals 406 and the base stations 304 through the data network 402 and the terminal controller 404. In an embodiment, the terminals are connected with a serial cable, for instance, to the terminal controller which in an embodiment is a computer. In another embodiment, the terminals are not conventional subscriber terminals, but especially arranged to make the measurements, so as to make their management possible by the network management system through the data network and the terminal controller. The terminals 406 and the terminal controller 404 are preferably fixed to the office environment to make it possible to perform measurements weekly, for instance.

The network management system 414 also receives the measurement reports on the connection quality between the terminals 406 and the base stations 304, and the measurement reports are sent from the terminals 406 to the base stations 304 from which they are forwarded to the network management system 414 through the base station controller 410. Information between the network management system 414 and the terminal controller 404 is transmitted in the data network 402 which most preferably is an IP network. The use of a data network between the network management system and the terminal controller makes even great physical distances possible, thus making it possible to remote operate office networks.

The search for frequencies for cellular radio networks for office use is co-ordinated by the controller 412 which controls the method steps described in Figure 2. It is not essential for the invention whether the controller 412 is separate from the network management system, as shown in Figure 4, or whether it is a part of the network management system 414. Most preferably, the controller 412 is, however, configured in such a manner that it is a part of the network management system, and all network management system services and interfaces can be used directly from the application. In Figure 4, a threshold value is first set for the controller 412 to evaluate the quality of the connections between the terminals 406 and the base stations 304. Before iterating the frequencies, the controller 412 commands the network management system 414 to switch the terminals 406 on through the

terminal controller 404 and starts the evaluation of the quality of the connections between the terminals 406 and the base stations 304 for the desired terminals 406. The controller 412 first selects the frequency to be tested and commands through the network management system 414 the base stations 304 to use this frequency. After directing the terminals 406 to use the frequency being tested, the controller 412 establishes a connection between the terminals 406 through the base stations 304 with the help of the terminal controller 404 and the data network 402. The measurement information on connection quality received by the network management system 414 is transmitted to the controller 412 which compares the measurement report with the set threshold value and determines whether the established connection and, consequently, the tested frequency is good enough. The method steps shown in Figure 2 are repeated under the control of the controller 412 until the required frequencies are found for the base stations 304 and the office base stations can be directed to use the found frequencies. Parts of the cellular radio network of the invention are preferably implemented by software run in a processor. Other parts can be implemented as hardware, for instance as an asic (application specific integrated circuit) or as a separate logic.

Even though the invention has been explained in the above with reference to examples in accordance with the accompanying drawings, it is obvious that the invention is not restricted to them but can be modified in many ways within the scope of the inventive idea disclosed in the attached claims.

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## CLAIMS

1. A method for performing channel configuration in a cellular radio network for office use located in the operating area of a macro cell network, **characterized by**

5 (210) selecting as the channel to be tested a logical control channel to be transmitted on the physical channel of a macro cell in the macro cell network,

(215) directing a base station of the cellular radio network for office use and terminals within the coverage area of the base stations of the cellular radio network for office use to use the channel to be tested,

10 (220) establishing by remote control a connection between two or more terminals through base stations serving the terminals on the channel being tested and making a measurement report on the quality of the connection,

15 (232) selecting as the channel to be tested the next control channel of a macro cell of the macro cell network until the control channels of all desired macro cells have been tested,

(235) determining on the basis of the measurement reports the channels whose use guarantees the best range in the cellular radio network for office use,

20 (245) directing the base stations of the cellular radio network for office use to use the channels guaranteeing the best range.

2. A method as claimed in claim 1, **characterized** in that the macro cell network and the cellular radio network for office use are controlled from the same location.

3. A method as claimed in claim 1, **characterized** in that the macro cell network and the cellular radio network for office use are synchronised with each other.

4. A method as claimed in claim 1, **characterized** in that a BCCH (broadcast control channel) is used as the control channel of the macro cell network.

5. A method as claimed in claim 1, **characterized** in that office base stations are used as the base stations of the cellular radio network for office use.

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6. A method as claimed in claim 1, **characterized** that mobile phones are used as the terminals.

7. A method as claimed in claim 1, **characterized** in that a threshold value that the connection quality must meet is used in evaluating the quality of the connection.

8. A method as claimed in claim 7, **characterized** in that a bit error ratio is used as the threshold value.

9. A method as claimed as claim 1, **characterized** in that the terminal controller of the cellular radio network for office use, controlling the operation of the terminals, is controlled through a data network connected to the cellular radio network for office use.

10. A method as claimed in claim 1, **characterized** in that the channel configuration of the cellular radio network for office use is performed when building the cellular radio network for office use.

11. A method as claimed in claim 1, **characterized** in that the channel configuration of the cellular radio network for office use is performed at regular intervals.

12. A method as claimed in claim 1, **characterized** in that the physical channel of a macro cell is a time-slot of a radio frequency, and the logical control channel of the macro cell is directed to be transmitted at its time through each time-slot of said frequency.

13. A cellular radio network comprising one or more macro cell base stations (302A to 302G), each coverage area being a macro cell (102) and the macro cells (102) forming a macro cell network; a cellular radio network for office use (300) operating in the operating area of the macro cell network, which cellular radio network for office use comprises at least one base station (304A to 304D) and at least one terminal (406) in radio connection with the base station,

**characterized** in that

the cellular radio network also comprises a controller (412) co-ordinating the channel configuration, the controller (412) comprising means for selecting as the channel to be tested a logical control channel to be transmitted on a physical channel of the macro cell (102), means for directing the base station (304A to 304D) of the cellular radio network for office use (300) to use the channel to be tested, means for establishing by remote control a connection between two or more terminals (406) through the base

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stations (304A to 304D) serving the terminals (406) on the channel being tested, means for making a measurement report on the connection quality, means for selecting as the channel to be tested the next control channel of a macro cell (102) until the control channels of all desired macro cells (102) have been tested, means for determining on the basis of the measurement reports the channels whose use guarantees the best range in the cellular radio network for office use (300), and means for directing the base stations (304A to 304D) to use the channels guaranteeing the best range.

14. A cellular radio network as claimed in claim 13,  
10 **characterized** in that the cellular radio network comprises a network management system for managing the macro cell network and the cellular radio network for office use.

15. A cellular radio network as claimed in claim 14,  
15 **characterized** in that the network management system is arranged to synchronise the cellular radio network and the macro cell network.

16. A cellular radio network as claimed in claim 13,  
**characterized** in that the control channel of the macro cell network is a BCCH (broadcast control channel).

17. A cellular radio network as claimed in claim 13,  
20 **characterized** in that the base stations of the cellular radio network for office use are office base stations.

18. A cellular radio network as claimed in claim 13,  
**characterized** in that the terminals are mobile phones.

19. A cellular radio network as claimed in claim 13,  
25 **characterized** in that the controller is arranged to use in evaluating the quality a threshold value that the connection quality must meet.

20. A cellular radio network as claimed in claim 19,  
**characterized** in that the controller is arranged to use a bit error ratio as the threshold value in evaluating the quality of the connection.

21. A cellular radio network as claimed in claim 13,  
30 **characterized** in that the cellular radio network comprises a data network for transmitting information in the cellular radio network and a terminal controller for controlling the terminals, and that the controller is arranged to control the terminal controller through the data network.

22. A cellular radio network as claimed in claim 13, **characterized** in that the controller comprises means for performing channel configuration when building the cellular radio network.

23. A cellular radio network as claimed in claim 13, **characterized** in that the controller comprises means for performing channel configuration of the cellular radio network at regular intervals.

24. A cellular radio network as claimed in claim 13, **characterized** in that the physical channel of the macro cell is a time-slot of a radio frequency, and the logical control channel is directed to be transmitted at its time through each time-slot of said frequency.

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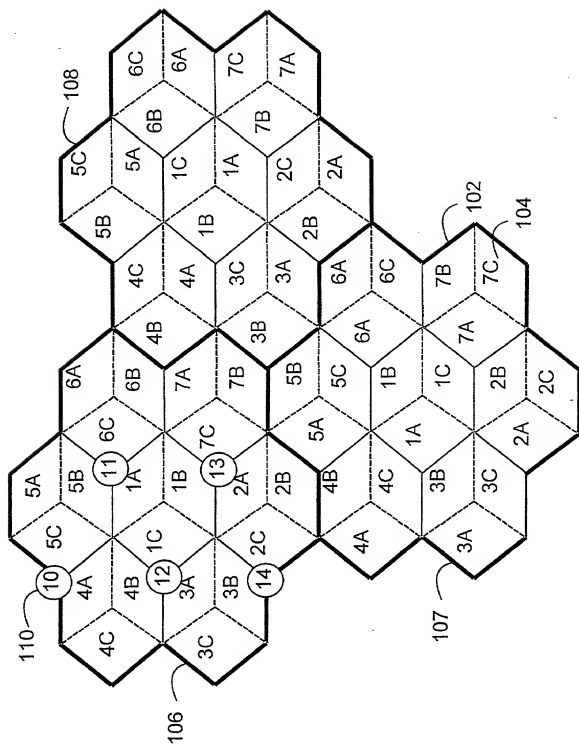


Fig. 1

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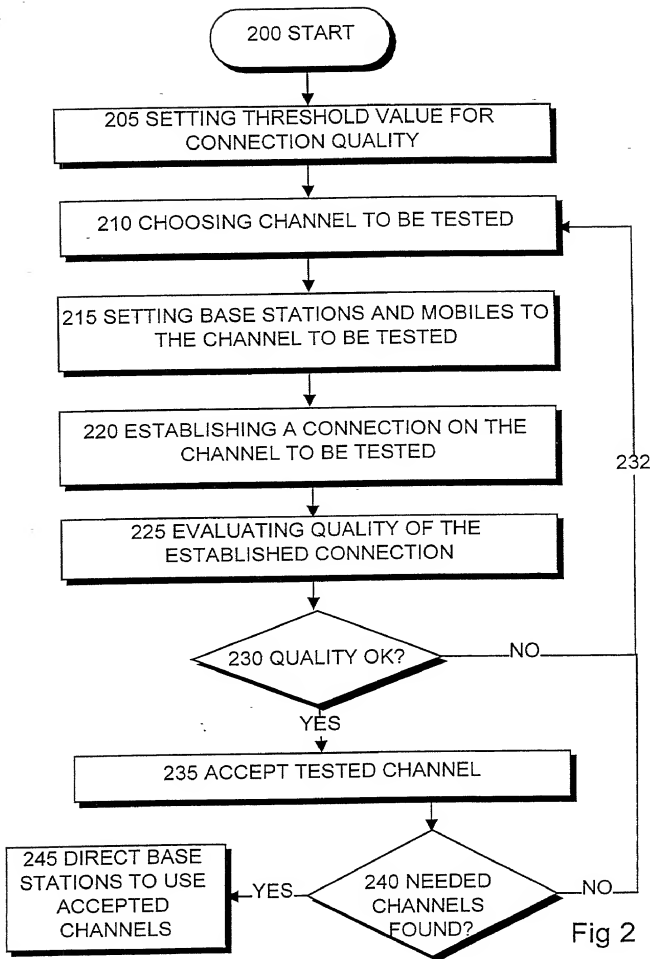


Fig 2

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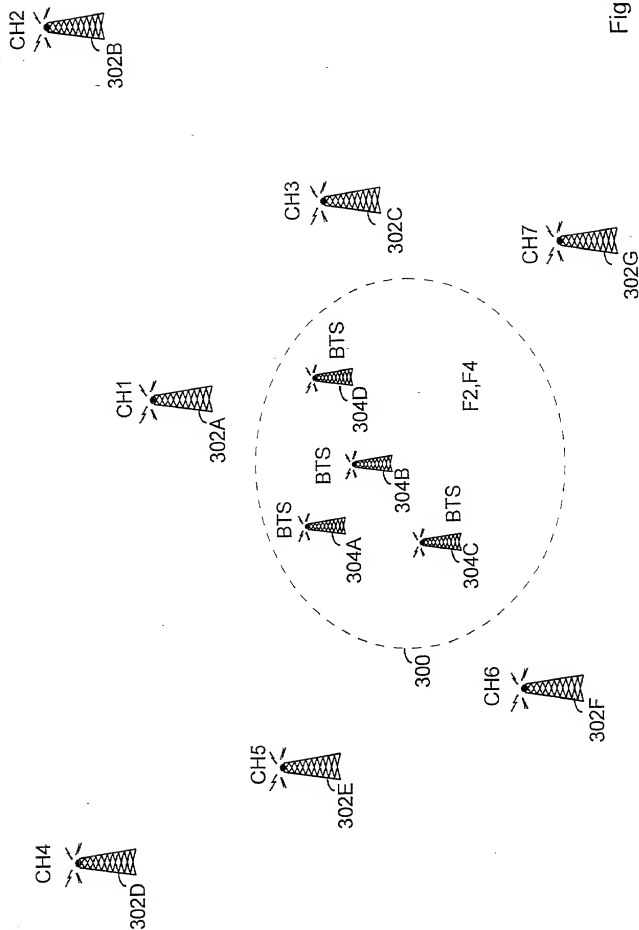


Fig. 3

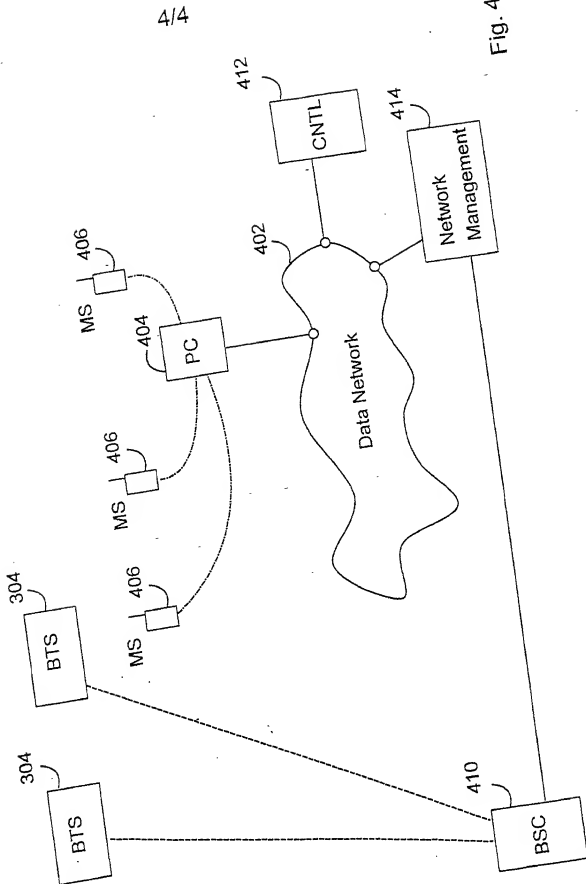


Fig. 4

FOR UTILITY/DISIGN  
CIP/PTC NATIONAL/PLANT  
ORIGINAL/SUBSTITUTE/SUPPLEMENTAL  
DECLARATIONS

RULE 63 (37 C.F.R. 1.63)  
DECLARATION AND POWER OF ATTORNEY  
FOR PATENT APPLICATION  
IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

PM & S  
FORM

As a below named inventor, I hereby declare that my residence, post office address and citizenship are as stated below next to my name, and I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the INVENTION ENTITLED

Method for channel configuration of cellular radio network, and cellular radio network

the specification of which (CHECK applicable BOX(ES))

X ☐ A ☐ is attached hereto.  
☒ B ☐ was filed on \_\_\_\_\_ as U.S. Application No. \_\_\_\_\_  
☒ C ☐ was filed as PCT International Application No. PCT/ FI00 / 00494 on 2 June 2000

and (if applicable to U.S. or PCT application) was amended on \_\_\_\_\_

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment referred to above. I acknowledge the duty to disclose all information known to me to be material to patentability as defined in 37 C.F.R. 1.56. I hereby claim foreign priority benefits under 35 U.S.C. 119(a)-(d) or 365(b) of any foreign application(s) for patent or inventor's certificate, or 365(a) of any PCT International Application which designated at least one other country than the United States, listed below and have also identified below any foreign application for patent or inventor's certificate, or PCT International Application, filed by me or my assignee disclosing the subject matter claimed in this application and having a filing date (1) before that of the application on which priority is claimed, or (2) if no priority claimed, before the filing date of this application:

PRIOR FOREIGN APPLICATION(S)

Number Country Day/MONTH/Year Filed

Date first Laid-  
open or Published

Date Patented  
or Granted

Priority Claimed  
Yes No

991285 FI 4 June 1999

X

I hereby claim domestic priority benefit under 35 U.S.C. 119(e) or 120 and 365(c) of the indicated United States applications listed below and PCT international applications listed above or below and, if this is a continuation-in-part (CIP) application, insofar as the subject matter disclosed and claimed in this application is in addition to that disclosed in such prior applications, I acknowledge the duty to disclose all information known to me to be material to patentability as defined in 37 C.F.R. 1.56 which became available between the filing date of each such prior application and the national or PCT international filing date of this application.

PRIOR U.S. PROVISIONAL, NONPROVISIONAL AND/OR PCT APPLICATION(S)

Application No. (series code/serial no.) Day/MONTH/Year Filed

Status

pending, abandoned, patented

Priority Claimed

Yes No

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

And I hereby appoint Pillsbury Madison & Sutro LLP, Intellectual Property Group, 1100 New York Avenue, N.W., Ninth Floor, East Tower, Washington, D.C. 20005-3918, telephone number (202) 861-3000 (to whom all communications are to be directed), and the below-named persons (if the same address) individually and collectively my attorneys to prosecute this application and to transact all business in the Patent and Trademark Office connected therewith and with the resulting patent, and I hereby authorize them to delete names/numbers below of persons no longer with their firm and to act and rely on instructions from and communicate directly with the person/assignee/attorney/firm/organization who/which first sends/sent this case to them and by whom/which I hereby declare that I have consented after full disclosure to be represented unless/until I instruct the above firm and/or a below attorney in writing to the contrary.

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Date: 13.12.2000

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Residence		City		Country of Citizenship	
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(FOR ADDITIONAL INVENTORS, check box ☐ to attach PAT 116-2 same information for each re signature, name, date, citizenship, residence and address.)